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DEPARTMENT OF DEFENSE HANDBOOK

CLASSIFICATION OF DEFECTS OF FLARELESS AND BEAM SEAL FITTINGS

This handbook is for guidance only. Do not cite this document as a requirement.

AMSC N/A FSC 4730

FOREWORD

1. This handbook is approved for use by all Departments and Agencies of the Department of Defense.

2. This handbook cannot be cited as a requirement. If it is, the contractor does not have to comply.

3. This standard classifies various defects of flareless and beam seal fittings and defines rejection and acceptance criteria and Quality Assurance Provisions.

4. Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Naval Air Warfare Center Aircraft Division, Code 414100B120-1, Highway 547, Lakehurst, NJ 08733-5100 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

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1. SCOPE

1.1 Scope. This handbook establishes a classification of commonly occurring defects applicable to flareless fittings and beam seal fittings specified in military specifications MIL-F-18280, MIL-F-85421, MIL-F-85720, and DoD adopted non-Government standards.

1.2 Classification. This handbook defines the classification of defects, critical defects, major defects, and minor defects of parts standards and design standards based upon the effect on usability.

1.3 Purpose. This handbook lists the defects in tabular format, class of defects, applicable defect number, description of defects and references in relation to the corresponding MS drawings to identify the defective parts.

1.4 Applicability. The requirements specified herein apply to all flareless fittings and beam seal fittings specified in military specifications MIL-F-18280, MIL-F-85421, and MIL-F-85720 for use in aerospace fluid systems.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed below are not necessarily all of the documents referenced herein, but are the ones that are needed in order to fully understand the information provided by this handbook.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto (see 6.2).

SPECIFICATIONS

DEPARTMENT OF DEFENSE

MIL-F-18280	-	Fittings Flareless Tube, Fluid connection
MIL-F-85421/1	-	Fitting End, Standard Dimensions for Beam Seal, Male
MIL-F-85421/2	-	Fitting End, Standard Dimensions for Bulkhead, Beam Seal, Male
MIL-F-85421/3	-	Tee, Reducer, Beam Seal, 3000/4000 psi, 3 Male Ends
MIL-F-85421/4	-	Tee, Reducer, Beam Seal, 3000/4000 psi, Male on Run, Swivel Nut on Branch
MIL-F-85421/5	-	Tee, Reducer, Beam Seal, 3000/4000 psi, Male on Run and Branch, Swivel Nut on Run
MIL-F-85421/10	-	Adapter, Beam Seal, 3000/4000 psi, Male to Flareless

MIL-F-85421/11	-	Union, Beam Seal, 3000/4000 psi, Male Ends
MIL-F-85421/12	-	Elbow, 90°, Beam Seal, 3000/4000 psi, Male to Male
MIL-F-85421/13	-	Elbow, 90°, Beam Seal, 3000/4000 psi, Bulkhead, Male Ends
MIL-F-85421/14	-	Elbow, 90°, Beam Seal, 3000/4000 psi, Bulkhead, Male to Female
MIL-F-85421/15	-	Elbow, 45°, Beam Seal, 3000/4000 psi, Bulkhead, Male Ends
MIL-F-85421/16	-	Tee, Beam Seal, 3000/4000 psi, Bulkhead on Run, 3 Male Ends
MIL-F-85421/17	-	Tee, Beam Seal, 3000/4000 psi, Bulkhead on Branch, Male Ends

STANDARDS

DEPARTMENT OF DEFENSE

MS21900	-	Adapter, Flareless Tube to AN Flared Tube
MS21902	-	Union, Flareless Tube
MS21903	-	Union, Flareless Tube, 3/8 Bulkhead and Universal
MS21904	-	Elbow, Flareless Tube, 90°
MS21905	-	Tee, Flareless Tube
MS21906	-	Cross, Flareless Tube
MS21907	-	Elbow, Flareless Tube and Universal 45°
MS21908	-	Elbow, Bulkhead Universal 90 Deg., Flareless Tube
MS21909	-	Tee, Bulkhead and Universal, Flareless Tube
MS21910	-	Tee, Flareless Tube, Internal Thread on Side
MS21911	-	Tee, Bulkhead Flareless Tube, Internal Thread on Run
MS21912	-	Tee, Flareless Tube with Bulkhead on Run
MS21913	-	Plug, Flareless Tube
MS21914	-	Cap, Pressure Seal, Flareless Tube Fitting
MS21915	-	Bushing, Screw-Thread Expander, Flareless Tube Connection
MS21916	-	Reducer, External Thread, Flareless Tube
MS21921	-	Nut, Sleeve Coupling, Flareless
MS21922	-	Sleeve, Coupling, Flareless
MS21923	-	Adapter, Flareless Tube, Bulkhead and Universal to Flared Tube
MS21924	-	Union, Flareless Tube, Bulkhead and Universal
MS21925	-	Elbow, 90° Universal, Flareless Tube, High Profile
MS21926	-	Elbow, 90° Universal, Flareless Tube, Low Profile
MS21933	-	Fitting End, Bolt Cluster Fitting, Single Port, Through, Flareless
MS21935	-	Fitting End, Bolt Cluster Fitting, Double Port, Through, Flareless
MS21937	-	Nut, Cluster Fitting, Retainer
MS21938	-	Bolt, Cluster Fitting, Single Port, Flareless

MS21939	-	Bolt, Cluster Fitting, Single Port, Through, Flareless
MS21940	-	Bolt, Cluster Fitting, Double Port, Flareless
MS21941	-	Bolt, Cluster Fitting, Double Port, Through, Flareless
MS21942	-	Body, Cluster Fitting, One Way, Flareless
MS21943	-	Body, Cluster Fitting, Two Way, 90°, Flareless
MS21944	-	Body, Cluster Fitting, Two Way, 180°, Flareless
MS21945	-	Body, Cluster Fitting, Three Way, Flareless
MS24405	-	Adapter, Flareless Tube to AN Flared Tube, Precision Type
MS24651	-	Elbow, Tube - 90°, Bulkhead, Flareless Tube Universal to Flared Tube
MS24652	-	Elbow, Tube - 90°, Bulkhead, Flareless Tube Universal to Flareless Tube
MS24654	-	Elbow, Tube - 45°, Bulkhead, Flareless Tube Universal to Flared Tube
MS33514	-	Fitting End, Standard Dimensions for Flareless Tube Connection and Gasket Seal
MS33515	-	Fitting End, Standard Dimensions for Bulkhead Flareless Tube Connections

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other Government documents, drawings, and publications. The following other Government documents, drawings and publications form a part of this document to the extent specified herein.

PUBLICATIONS

AIR FORCE - NAVY AERONAUTICAL BULLETIN

ANA-431 - Fittings, Flared, Classification of Defects

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific acquisition functions should be obtained from the acquiring activity or as directed by the Contracting Officer.)

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the latest issue of the DoDISS and supplement thereto.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASQC Z1.4 - Sampling Procedures and Tables for Inspection by Attributes (DoD adopted)

(Application for copies should be addressed to the American National Standards Institute (ANSI) 11 West 42nd Street, New York, NY 10036)

SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

AS STANDARDS (SAE)

SAE-AS1001	-	Tee, Reducer, Bulkhead on Run, Internal Port on Side, Flareless Tube (DoD adopted)
SAE-AS1002	-	Tee, Reducer, Bulkhead and Internal Port on Run, Flareless Tube (DoD adopted)
SAE-AS1003	-	Tee, Reducer, Bulkhead on Run, Flareless Tube (DoD adopted)
SAE-AS1004	-	Elbow, 90°, Reducer, Flareless Tube (DoD adopted)
SAE-AS1005	-	Tee, Reducer, Flareless Tube (DoD adopted)
SAE-AS1006	-	Cross, Reducer, Flareless Tube (DoD adopted)
SAE-AS1007	-	Union, Reducer, Flareless Tube (DoD adopted)
SAE-AS1008	-	Elbow, 90°, Reducer, Bulkhead, Flareless Tube (DoD adopted)
SAE-AS1009	-	Tee, Reducer, Bulkhead on Side, Flareless Tube (DoD adopted)
SAE-AS1010	-	Elbow, 45°, Reducer, Flareless Tube (DoD adopted)

(Applications for copies should be addressed to the Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15098.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. DEFINITIONS

3.1 Acceptable Quality Level (AQL). When a continuous series of lots is considered, the AQL is the quality level which, for the purposes of sampling inspection, is the limit of a satisfactory process average (see 4.3.1).

3.2 Classification of defects. A classification of defects is the enumeration of possible defects of the unit of product classified according to their seriousness.

3.3 Critical defect. A critical defect is a defect which reduce materially the usability of the product for its intended purposes and resulted in failure of the system or equipment or both system and equipment.

3.4 Defect. A defect is any nonconformance of the unit of product with specified requirements.

3.5 Imperfect thread. The runout thread on externally threaded parts is incomplete and less than one pitch in length, causing abrupt change in cross sectional area.

3.6 Inspection. Inspection is the process of measuring, examining, testing, or otherwise comparing the unit of product with the requirements.

3.7 Leg length. The length of the port, male or female, measured from the end of the part to the center of the body vertically or horizontally.

3.8 Major defect. A major defect is a defect, other than critical, that will have effect on usability that is likely to result in failure if used, or it will reduce materially the usability of the unit of product for its intended purpose.

3.9 Minor defect. A minor defect is a defect other than major, essentially no effect on usability, that is not likely to reduce materially the usability of the unit of product for its intended purpose, or having little bearing on the effective use or operation of the unit.

3.10 Not measurement sensitive document. A document in which application of the requirements does not depend substantially on some measured quantity. This type of document can be used with either a metric system or an inch-pound system.

3.11 Sampling plan. A sampling plan indicates the number of units of product from each lot or batch which are to be inspected (sample size or series of sample sizes) and the criteria for determining the acceptability of the lot or batch (acceptance and rejection numbers).

3.12 Shape fitting. A fitting where the body of fitting is not in a straight line and flow of fluid within the inside diameter of fitting is at an angle. Fittings such as tees, elbows, and crosses are classified as shape fittings.

3.13 Straight fitting. A body of fitting is in a straight line and flow of fluid within inside diameter of fitting is at a straight line direction. Fittings such as adapters, unions, and plugs are classified as straight fittings.

3.14 Thread lead. The entering end of external threads and the entering end of internal threads is outside of the specified limits of size for a length not to exceed two pitches including chamfer.

4. GENERAL REQUIREMENTS

4.1 Classification of defects. Defects are herein considered for classification in accordance with the effect they have on safety and usability.

4.2 Acceptability of classifications. These classifications should govern the acceptance inspection of fittings when so indicated in the fitting specification or drawing or in the acquisition document, and should be applied to inspection of fittings manufactured under such specifications or drawings.

4.3 Sampling. When acceptance inspection for these parts is done by sampling, the sampling plan will be specified in the appropriate acquisition document. If no specific document is specified, the sampling plan will be in accordance with ANSI-Z1.4, and the AQL will be as specified in the contract.

4.3.1 Acceptable quality level (AQL). The acceptable quality level is applied by class of defects. The acceptable quality level should be provided in the contract by the contracting activity or acquiring activity. The following AQL has been used successfully in the past and is recommended for use.

Critical - 0 percent
Major - 1.5 percent
Minor - 4.0 percent

5. DETAILED REQUIREMENTS

5.1 Classification of defects.

5.1.1 MS33514 flareless end design standard.

TABLE I. Classification of defects of MS33514.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	X	Distance from gauge dia to tube stop	
	102	T	Thread per specification	
	103	-	24° Seat angle	
Major	201	-	Surface finish - seat	
	202	F	Undercut dia	
	203	-	Surface finish - F dia	
	204	W	Squareness of face to threads	
	205	Q	Undercut width	
	206	-	Concentricity - seat to threads	
	207	A	Dia - ID	
	208	D	Dia - tube stop to seat dia	
	209	-	75° - tube stop angle	
	210	E	Distance across hex flats	

	211	H	Seat depth	
	212	J	Thread or end length	
	213	Y	Thread chamfer dia	
Minor	301	K	Hex chamfer dia	
	302	M	Rad ID at tube stop	
	303	V	Rad - Corner at tube stop	
	304	-	R1 radius - F dia and hex face	R1 =
	305	-	15° - Hex chamfer angle	.016/.031
	306	-	45° - Thread chamfer angle	
	307	-	Imperfect threads	
	308	-	R2 - radius - thread chamfer at F dia	R2 =
	309	-	Concentricity - F dia to thread	.005/.015

5.1.2 MS33515 Bulkhead flareless end design standard.

TABLE II. Classification of defects of MS33515.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	X	Distance from gauge dia to tube stop	
	102	T	Thread per specification	
	103	-	24° - Seat angle	
Major	201	-	Surface finish - seat (micro inches)	63 R_a max
	202	F	Undercut diameter	-
	203	-	Surface finish - F dia (micro inches)	63 R_a min
	204	W	Squareness of face to threads	
	205	N	Undercut width	
	206	-	Concentricity - seat to threads	
	207	-	Continuation of same thread lead	
	208	A	Tube - ID	
	209	D	Tube stop to seat dia	
	210	-	75° - Tube stop angle	
	211	E	Distance across hex flats	
	212	H	Seat depth	
	213	K	Distance from shoulder to seat end	
	214	E	Hex chamfer dia	
	215	M	Rad - ID at tube stop	
	216	V	Rad - Corner at tube stop	
	217	Y	Thread chamfer dia	
	218	-	Concentricity - F dia to thread	

	219	P	Distance from center undercut to seat end	
Minor	301	-	Radius - G dia and shoulder	
	302	-	15° - Hex chamfer angle	
	303	-	45° - Thread chamfer angle	
	304	L	.031 - Shoulder length	
	305	-	Radius - Thread chamfer at F and G dia	1/
	306	R	Flange width	
	307	S	Flange dia	
	308	J	Shoulder dia	
	309	G	Back undercut dia	
	310	Q	Back undercut width	
	311	-	Radius - J dia and flange	2/

1/ Rf = .005/.015, Rg = .015/.030
2/ Rg = .005/.010

5.1.3 MS21921 Nut.

TABLE III. Classification of defects of MS21921.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	T	Thread in accordance with specification	
	102	E	Small ID	
	103	-	Concentricity - E and K diameters to thread	
		-	Material per specification or as in contract	
Major	201	A	Overall length	
	202	B	OD turn length	
	203	-	20° - Hex chamfer angle at B length	
	204	-	15° - Hex chamfer angle at tail	
	205	H	Hex chamfer dia at tail	
	206	C	OD. turn diameter	
	207	-	.016 - Corner break width on C diameter	
	208	-	45° - Corner break angle on C diameter	
	209	D	Thread chamfer dia	
	210	F	Full thread length	
	211	G	Distance from inside shoulder to front	
	212	K	Surface finish - internal 45° seat (micro inches)	125 R_a
	213	-	Finish - per specification	min
Minor	301	-	90° - Thread chamfer angle	
	302	K	Internal 45° seat dia	
	303	-	45° - Internal seat angle	

	304	-	Radius - Seat angle and E dia	
	305	-	.005 - Corner break width at E dia and tail	
	306	-	45° - Corner break single at E dia and tail	
	307	-	Break edges and remove burrs	
	308	-	Marking - per specification	

5.1.4 Shape fittings, military standards. MS21904, MS21905, MS21906, MS21907, MS21908, MS21909, MS21910, MS21911, MS21912, MS21925, MS21926, MS24651, MS24652, MS24654.

TABLE IV. Classification of defects of shape fittings, military standards.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	-	Incomplete, incorrect or missing holes	
	102	-	Internal burrs	
	103	-	Fitting end per design standard	
	104	-	Material per specification or as in contract	
Major	201	-	Leg length, short flareless end	
	202	-	Leg length, bulkhead flareless end	
	203	-	Leg length, short flared end	
	204	-	Leg length, bulkhead flared end	
	205	-	Leg length, boss end	
	206	-	Drill depth, short flareless end	
	207	-	Drill depth, bulkhead flareless end	
	208	-	Drill depth, short flared end	
	209	-	Drill depth, bulkhead flared end	
	210	-	Drill depth, boss end	
	211	-	Distance across wrench pads	
	212	-	Angle between legs	
	213	K	Thread length of high profile flareless end	1/
	214	K	End length of universal low profile flareless end	2/
	-			
	215	-	Finish per specification	
Minor	301	R	External corner radius forging on elbows	
	302	U	Filet corner radius of forging on OD of legs at intersections	
		-		
	303	H	Radius at back of flange on bulkhead end	
	304	-	Perfect thread depth on boss end	
	305	Z	OD dia of boss end	

	306	K	Flange thickness at boss end	
	307	K	Break edges and remove burrs	
	308	-	Marking per specification	

1/ Applicable to MS21925 only.
2/ Applicable to MS21926 only.

5.1.5 Shape fittings. DoD adopted non-Government standards AS1001, AS1002, AS1003, AS1004, AS1005, AS1006, AS1008, AS1009, AS1010.

TABLE V. Classification of defects of shape fittings, DoD adopted non-Government standards.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	-	Incomplete, incorrect or missing holes	
	102	-	Internal burrs	
	103	-	Fitting end per design std	
	104	-	Material per specification or as in contract	
Major	201	-	Leg length, short flareless end	
	202	-	Leg length, bulkhead flareless end	
	203	-	Leg length, short flared end	
	204	-	Leg length, bulkhead flared end	
	205	-	Leg length, boss end	
	206	-	Drill depth, short flareless end	
	207	-	Drill depth, bulkhead flareless end	
	208	-	Drill depth, short flared end	
	209	-	Drill depth, bulkhead flared end	
	210	-	Drill depth, boss end	
	211	-	Distance across wrench pads	
	212	-	Angle between legs	
	213	-	Finish per specification	
Minor	301	-	Perfect thread depth on boss end	
	302	-	OD dia of boss end	
	303	-	Flange thickness at boss end	
	304	-	Break edges and remove burrs	
	305	-	Marking per specification	

5.1.6 Straight fittings, military standards. MS21900, MS21902, MS21903, MS21913, MS21915, MS21916, MS21923, MS21924, MS24405.

TABLE VI. Classification of defects of straight fittings, military standards.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	-	Incomplete, incorrect or missing holes	
	102	-	Internal burrs	
	103	-	Fitting end per design standards	
	104	-	Material per specification or as in contract	
	105	T	Thread per specification	
Major	201	-	Overall length	
	202	-	Length, end to hex face, bulkhead flareless end	
	203	-	Shoulder width, bulkhead flareless end	W= .313
	204	Q	Undercut width, flareless end dia	1/
	205	-	Drill depth, short flareless end	
	206	-	Drill depth, bulkhead flareless end	
	207	-	Drill depth, internal port	
	208	-	Distance across hex flats	
	209	-	Surface finish, undercut dia and hex face,	
	-	-	flareless end	1/
	210	-	Finish per specification	
Minor	301	-	15° - Hex chamfer angle	2/
	302	-	Groove depth in hex corners	1/
	303	-	Groove position in hex corners	1/
	304	-	Groove angle in hex corners	1/
	305	-	Break edges and remove burrs	
	306	-	Marking per specification	

1/ Applicable to MS24405 only
2/ Applicable to MS21913 and MS21915

5.1.7 Straight fittings, DoD adopted non-Government standard. AS1007

TABLE VII. Classification of defects of straight fittings DoD adopted non-Government standard.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	-	Incomplete, incorrect or missing holes	
	102	-	Internal burrs	
	103	-	Fitting end per design standard	

	104	-	Material per specification or as in contract	
	105	T	Thread T in accordance with specification	
Major	201	A	Overall length	
	202	-	Drill depth, short flareless end	
	203	-	Drill depth, bulkhead flareless end	
	204	-	Distance across hex flats	
	205	-	Surface finish, undercut dia and hex face	
	206	-	Finish per specification	
Minor	301	-	Break edges and remove burrs	
	302	-	Marking per specification	

5.1.8 MS21914 cap assembly.

TABLE VIII. Classification of defects of MS21914.

Class of defect	Defect No	References on drawing	Items to be examined	Notes
Critical	101	-	Fitting end per design standard	
	102	T	Thread per specification	
	103	-	Material per specification or as in contract	
Major	201	-	Nut free to swivel	
	202	-	Finish per specification	
	203	W	Retainer wire within hex limits	
	204	L	Length of assembly	
	205	B	Hex nut	
	206	C	Diameter	
	207	A	Length of insert	
Minor	301	-	Break edges and remove burrs	.

5.1.9 MS21933 Single port cluster bolt end design standard.

TABLE IX. Classification of defects of MS21933.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	K	Sealing lands dia	
	102	-	Surface finish - sealing lands	
	-	-	(micro inch)	16 R_a

	103		Fitting end per design standard	
Major	201	A	End length	
	202	B	Length over lands	
	203	C	Length to front land	
	204	D	Cross hole position	
	205	E	Length to back land	
	206	F	Land chamfer length	
	207	G	Cross hole dia	
	208	H	Front undercut dia	
	209	J	Center relief dia	
	210	L	Back undercut dia	
	211	-	Surface finish per specification	
	212	-	Concentricity - J and K dia to thread	.005 TIR
Minor	301	-	45° - Back thread chamfer	
	302	-	.135/.090 - Front undercut width	
	303	-	.056/.021 Rad - Front undercut radii	
	304	-	.094/.031 Rad - Land chamfer radii	
	305	-	30° - Land chamfers	
	306	-	.026 Rad - Back undercut radius	
	307	-	.052 - Back undercut width	

5.1.10 MS21935 Double port cluster bolt end design standard.

TABLE X. Classification of defects of MS21935.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	M	Sealing lands dia	
	102	-	Surface finish - sealing lands(micro inch)	16 R_a min
	103	-	Fitting end per design standard	
Major	201	A	End length	
	202	B	Length over lands	
	203	C	Length to front land	
	204	D	Length to front cross hole	
	205	E	Length to front of center land	
	206	F	Length to back of center land	
	207	G	Length to back cross hole	
	208	H	Length to back land	
	209	J	Front undercut dia	
	210	K	Cross holes dia	
	211	L	Relief dia	
	212	N	Back undercut dia	
	213	P	Land chamfer length	

	214	-	Surface finish per specification	.005 TIR
	215	-	Concentricity - L and M dia to thread	
Minor	310	-	45° - Back thread chamfer	
	311	-	.090/.135 - Front undercut width	
	312	-	.056/.021 Rad - Front undercut radii	
	313	-	.094/.031 Rad - Land chamfer radii	
	314	-	30° - Land chamfers	
	315	-	.026 Rad - Back undercut radius	
	316	-	.052 - Back undercut width	

5.1.11 MS21922 Sleeve.

TABLE XI. Classification of defects of MS21922.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	-	Surface finish, shoulder, internal dia. and sharp	
	-	-	cutting edge	
	102	-	35° - shoulder angle	
	103	H	OD of shoulder	
	104	-	Material per specification or as in contract	
Major	201	B	Distance from shoulder back to pilot end	
	202	D	OD of tail	
	203	E	ID	
	204	G	OD of barrel	
	205	-	.020 Rad - Front of shoulder and barrel	
	206	C	Width of shoulder	
	207	-	Concentricity - D.E.F. and G dia	
	208	A	Overall length	
	209	-	.030 - Groove width	
	210	-	.030 - Groove location from shoulder	
	211	-	.010/.005 Groove depth	
	212	-	Finish - per specification	
Minor	301	J	Dia - ID. of pilot after spinning	
	302	-	Radius - ID. and OD at tail	
	303	-	Radius - Shoulder angle and tail	R at 2° angle
	304	-	12° - Pilot angle after spinning (see note)	
	305	-	Marking - per specification	

Note: The following items are not inspectable after spinning the pilot to 12° after machining:

F Dia - ID of pilot before spinning
K - Distance from edge to pilot end
R Rad - Edge and pilot ID
S Rad - Barrel OD at pilot end
2° - Cutting edge angle

5.1.12 MS21937 Nut.

TABLE XII. Classification of defects of MS21937.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	T	Thread per specification	
	102		Material per specification or as in contract	
Major	201	A	Overall length	
	202	B	Hex chamfer dia	
	203	C	Countersink dia	
	204	D	Angle of lock-wired hole	
	205	E	Counter bore dia	
	206	F	Outside turn dia	
	207	H	Distance across hex flats	
	208	-	Finish - per specification	
Minor	301	-	.156 - length of outside turn dia	
	302	-	15° - angle of hex chamfer	
	303	-	Corner of hex chamfer and turn dia	.031 Rad
	304		45° - angle of countersink	
	305	-	.165/.125 - length of counter bore	
	306	-	.062 Dia - lock-wired hole dia	
	307	-	.031 - Position of lock-wired hole	
	308	-	Break edges and remove burrs	
	309	-	Marking - per specification	

5.1.13 Cluster bolts, single and double port. MS21938, MS21939, MS21940, MS21941.

TABLE XIII. Classification of defects of MS21938, MS21939, MS21940, MS21941.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	-	Incomplete, incorrect or missing holes	
	102	-	Internal burrs	
	103	-	Fitting end per design standard	
	104	-	Material per specification or as in contract	
	105	T	Thread per specification	
Major	201	-	Overall length	
	202	-	Drill depth, past cross hole	
	203	-	Drill depth, short flareless end	
	204	-	Drill depth, long flareless end	
	205	-	Drill hole dia	
	206	-	Surface finish, outside machined surfaces	
	207	-	Surface finish, inside surfaces	
Minor	301	-	Hex chamfer angle	
	302	-	Hex chamfer dia	
	303	-	Break edges and remove burrs	
	304	-	Marking per specification	
	305	-	Finish per specification	

5.1.14 Cluster bodies, one, two, and three way. MS21942, MS21943, MS21944, MS21945.

TABLE XIV. Classification of defects of MS21942, MS21943, MS21944, MS21945.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	-	Incomplete, incorrect or missing holes	
	102	-	Internal burrs	
	103	-	Fitting end per design standard	
	104	-	Material per specification or as in contract	
	105	T	Thread per specification	
Major	201	E	Leg length	
	201	-	Angle between legs	90° ±2 ½°
	202	C	Leg turn length	
	203	-	Surface finish machined surfaces	

	204	-	Finish per specification	
Minor	301 302 303 304 305	- - D - -	Chamfer angle at body and leg .031 - Radius at body and leg Chamfer dia at body and leg Break edges and remove burrs Marking per specification	10° ± 5°

5.1.15 Beam seal end design standards. MIL-F-85421/1, MIL-F-85421/2, MIL-F-85720/1(AS)

TABLE XV. Classification of defects of MIL-F-85421/1, MIL-F-85421/2, MIL-F-85720/1(AS).

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101 102 103 104	- F T B	Sealing surface per specification Angle F° Thread per specification Outer rim sealing surface	
Major	201 202 203 204 205 206 207 208 209 210	- - - J - C - A E H	.015/.000 undercut at thread relief .030/.015 radius undercut .031 dimension bulkhead Dimension Concentricity- A, B, C to threads Diameter Finish per specification Tube ID Dimension thread length Dimension	 1/ .005 FIM
Minor	301 302 303 304 305 306	G - M D - -	Dimension 45° - chamfer dia Hex chamfer dia Dimension Break edges and remove burrs Marking per specification	

1/ Applicable to MIL-F-85421/2 only

5.1.16 Straight fittings, beam seal, military standards. MIL-F-85421/10,

MIL-F-85421/11

TABLE XVI. Classification of defects of straight fittings, beam seal, military standards.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	-	Fitting end per design standard	
	102	T	Thread per specification	
	103	-	Material per specification or as in contract	
Major	201	G	Dimension	
	202	B	Dimension	
	203	-	Machined surface per specification	
	204	-	Concentricity D, H, and J to thread	
	205	-	Surface finish per specification	
	206	E	Hex - across flats	
	207	-	Overall length	
Minor	301	-	45° ± 5° chamfer	
	302	F	Diameter	
	303	C	Hex width	
	304	-	15° ± 5° chamfer	
	305	-	Marking per specification	

5.1.17 Shape fittings, beam seal, military standards. MIL-F-58421/3, MIL-F-8421/4, MIL-F-85421/5, MIL-F-85421/12, MIL-F-85421/13, MIL-F-85421/14, MIL-F-85421/15, MIL-F-85421/16, MIL-F-85421/17.

TABLE XVII. Classification of defects of shape fittings, beam seal, military standards.

Class of defect	Defect No.	References on drawing	Items to be examined	Notes
Critical	101	-	Fitting ends per design standard	
	102	-	Distance, sealing surface to center body	
	103	T	Thread per specification	
	104		Material per specification or as in contract	
Major	201	-	Leg length port 1	
	202	-	Leg length port 2	
	203	-	Leg length port 3	
	204	-	Angle between legs	
	205	-	Surface finish per specification	

	206	-	Hex dimension across flats	
Minor	301 302 303	E - -	Radius .030/.125 Break radius Marking -per specification	

5.2 Boss fitting end (MS33649) and flared fitting end design standards. Classification of defects for boss fitting end and flared fitting end design standards will be found in ANA 431 bulletin.

6. NOTES

(This section contains information of a general or explanatory nature which may be helpful, but is not mandatory).

6.1 Intended use. This handbook contains inspection and test guidelines for beam seal and flareless fittings acquired by Government Agencies that are intended for use in aerospace fluid systems. Documents conforming to the requirements of this handbook are intended for use as DoD standardization documents and are listed in the DoDISS. This handbook established a common format throughout the DoD for the preparation of flareless fitting and beam seal fitting specifications and standards citing classification of defects.

6.2 Issue of DoDISS. When this handbook is used in acquisition, the applicable issue of the DoDISS should be cited in the solicitation (see 2.1 and 2.2.1).

6.3 Superseding data. This handbook supersedes MIL-STD-1655 dated 10 April 1975.

6.4 Subject term (keyword) listing.

Critical defect
Defect
Defective
Examination
Fluid connector
Inspection
Major defect
Minor defect
Quality assurance

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

CONCLUDING MATERIAL

Custodians:
Army - AV
Navy - AS
Air Force - 99

Review activities:
Navy - MC
Air Force - 82
DLA - CS, DCMA

Preparing activity:
Navy - AS
(Project 4730-0495)

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-HDBK-1655	2. DOCUMENT DATE (*YYMMDD*) 1997 March 17

3. DOCUMENT TITLE
CLASSIFICATION OF DEFECTS OF FLARELESS AND BEAM SEAL FITTINGS

4. NATURE OF CHANGE (*Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.*)

5. REASON FOR RECOMMENDATION

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